

R E M A R K S

Claims 1-16 and 23-28 are in the application, with non-elected claims 17-22 having been cancelled. Claims 1 and 23 are the independent claims herein. No amendments have been made to the claims that are still pending; no new matter has been added. Reconsideration and further examination are respectfully requested in view of the following remarks. Applicant hereby affirms his election of claims 1-16 and 23-28 for prosecution herein.

Claim Rejections – 35 USC § 103(a)

Claims 1-16 and 23-28 are rejected as being unpatentable over Messina et al. U.S. Patent No. 5,239,200 (“Messina”) in view of U.S. Patent No. 6,094,919 (“Bhatia”) and U.S. Patent No. 6,722,140 (“Venkatasubramanian”).

Claim 1 is directed to an “apparatus” which includes “an integrated circuit (IC) die having a front surface on which an integrated circuit is formed and a rear surface that is opposite to the front surface”. The apparatus of claim 1 further includes “a member to define at least one microchannel at the rear surface of the IC die, the microchannel to allow a coolant to flow therethrough”. In addition, the apparatus of claim 1 includes “at least one thin film thermoelectric cooling (TFTEC) device in the at least one microchannel”.

In formulating the rejection of claim 1, the Examiner relied on an asserted combination of the Messina and Bhatia references. However, applicant respectfully traverses the rejection of claim 1 and will demonstrate in remarks to follow that the references relied upon by the Examiner, taken alone or in combination, fail to disclose the claimed feature of a thin film thermoelectric cooling device that is located in a microchannel defined at a rear surface of an IC die.

To provide an overview of the most relevant teachings of the two references, Messina discloses a cooling plate 20 which operates to conduct heat away from ICs 16. The cooling plate 20 has formed therein channels 22, which the Examiner considers to be microchannels. A

coolant flows through the channels 22. Bhatia is cited for its disclosure of a thermoelectric module 35 that is incorporated in the lid 34 for a package that holds an IC 42.

Applicant will now turn to a discussion of a number of significant flaws in the rejection as formulated by the Examiner--flaws which, applicant believes, make it appropriate for the Examiner to reconsider and withdraw the rejection of claim 1.

The first category of the flaws in the rejection relates to the Examiner's characterization of the Bhatia reference. Applicant believes that the Examiner has misstated in important respects exactly what Bhatia actually discloses. The following is how the Examiner described the Bhatia reference:

Bhatia discloses in figures 2-4, at least one thin film thermoelectric cooling device (element 35 consisting of channels P, N and represent [sic] for thermoelectric) in the at least one microchannel.

First, and most significantly, and contrary to the Examiner's statement, Bhatia does not disclose a thermoelectric cooling device in a microchannel. In fact, Bhatia does not in any way even show or refer to a microchannel, and thus cannot possibly disclose a thermoelectric cooling device in a microchannel. What Bhatia actually shows is a thermoelectric cooling device 35 incorporated in the lid of package for an IC. There is no teaching or suggestion whatever in Bhatia to the effect that the cooling device 35 could or should be disposed in a microchannel.

Moreover, Bhatia does not in any respect indicate that the cooling device 35 is a thin film cooling device. At column 3, lines 9-14, Bhatia states that the thermoelectric cooling device 35 is "constructed of P-type and N-type semiconductor material", and no mention is made at this point of the semiconductor material being formed of a thin film or films. Further, the details shown in FIG. 4 of the structure of thermoelectric cooling device 35 appear to be completely inconsistent with the thermoelectric cooling device being formed of one or more thin films.

Thus the actual disclosure of the Bhatia reference does not support the Examiner's characterization of the reference.

Another significant flaw in the Examiner's rejection of claim 1 lies in the Examiner's statement of the Examiner's conclusion of obviousness with respect to claim 1. This conclusion is reproduced below:

[I]t would have been obvious for one [of] ordinary skill in the art at the time of the invention to make cooling of Messina et al. to have thin film thermoelectric device as taught by Bhatia for be [sic: "the"] benefit of reducing heat.

Applicant finds it particularly significant that this conclusion of obviousness fails to take into consideration a key claim limitation, namely that the thermoelectric device of claim 1 is located in a microchannel. Applicant believes that if the Examiner had properly taken this claim limitation into consideration, it would not have been possible for the Examiner to conclude that the apparatus of claim 1 is rendered obvious by the combination of the Messina and Bhatia references. Neither of the references, nor the combination thereof, teaches or suggests placement of a thermoelectric cooling device in a microchannel in which a coolant flows for an IC die.

To summarize applicant's contentions with respect to claim 1, the Bhatia reference does not go beyond incorporating a thermoelectric cooling device in an IC package, and would not lead one of ordinary skill in the art to dispose such a device in the coolant channels disclosed in the Messina reference. It is therefore respectfully requested that the rejection of claim 1 be reconsidered and withdrawn.

The above remarks in regard to claim 1 are equally applicable to the only other pending independent claim, which is claim 23. Thus claim 23 is submitted as patentable on the same basis as claim 1. In addition, the other pending claims, all being dependent claims, are submitted as patentable on the same basis as the independent claims.

Further, it is believed that a separate basis for patentability also exists with respect to dependent claims 2, 13 and 24. Each of these claims recites the additional feature that the at least one thin film thermoelectric cooling device is formed on the rear surface of the IC die. The Examiner has asserted that this limitation is taught by the Bhatia reference, but applicant believes that this is another mischaracterization of the reference. Bhatia shows a thermoelectric cooling

device incorporated in an IC package lid and adjacent the rear surface of an IC, but does not show such a device formed on the rear surface of the IC.

Applicant also notes in passing that the Examiner does not appear to have addressed the additional limitation recited in dependent claim 10.



CONCLUSION

Accordingly, Applicant respectfully requests allowance of the pending claims. If any issues remain, or if the Examiner has any further suggestions for expediting allowance of the present application, the Examiner is kindly invited to contact the undersigned via telephone at (203) 972-3460.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Nathaniel Levin", written over a horizontal line.

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